

<110> Organization Name : Carlsberg A/S

Application Project

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<120> Title : Barley for production of flavor-stable beer  
<130> AppFileReference : 1  
<140> CurrentAppNumber :  
<141> CurrentFilingDate : \_\_\_\_-\_\_-\_\_

Sequence

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<213> OrganismName : Hordeum vulgare cv. Barke  
<400> PreSequenceString :  
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<212> Type : DNA

<211> Length : 4165

SequenceName : SEQ ID NO: 1

SequenceDescription : Barley genomic sequence of cv. Barke,  
spanning  
the start and stop codons of the gene encoding LOX-1

Sequence

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<213> OrganismName : Hordeum vulgare mutant D112

<400> PreSequenceString :

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gggcatgaac catgaccaccc agctcaagaa ccgcacacgc ccggctaaat ttccctacat	4080
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&lt;212&gt; Type : DNA

&lt;211&gt; Length : 4165

SequenceName : SEQ ID NO: 2

SequenceDescription : Barley genomic sequence of mutant D112 spanning the segment, corresponding to the region between the start and stop codons of the gene encoding LOX-1 of cv. Barke

## Sequence

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&lt;213&gt; OrganismName : Hordeum vulgare cv. Barke

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EFLLKTITLH DVPGRSGNL FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD	180
ELRNLRGDDQ QGPYQEHDR YRYDVYNDLG EGRPILGGNS DHPYPRRGRT ERKPNASDPS	240
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGEFDSFQDI	300
INLYEGGIKL PKVAALEELR KQFPQLQLKD LLPVGGDSLL KLPVPHIIQE NKQAWRTDEE	360
FAREVLAGVN PVMITRLTEF PPKSSLDP SK FGDHTSTITA EHIEKNLEGL TVQQALESNR	420
LYILDHHDRF MPFLIDVNLL PGNFYIYATRT LFFLRGDGRL TPLAIELSEP IIQGGLTTAK	480
SKVYTPVPSG SVEGWWELA KAYVAVNDSG WHQLVSHWLN THAVMEPFVI STNRHLSVTH	540
PVHKLLSPHY RDTMTINALA RQTLINAGGI FEMTVFPGKF ALGMSAVVYK DWKFTEQGLP	600
DDLIKRGMAV EDPSSPYKVR LLVSDIYPA DGLAIWHAIE QYVSEYLAIY YPNDGVQLQGD	660
TEVQAWWKET REVGHGDLKD APWWPKMQSV PELAKACTTI IWIGSALHAA VNFGQYPYAG	720
FLPNRPTVSR RRMPEPGTEE YAELERDPER AFIHTITSQI QTIIGVSLLE VLSKHSSDEL	780
YLGQRDTPEW TSDPKALEVF KRFSDRLVEI ESKVVGGMNH PELKNRNGPA KFPYMLLYPN	840
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&lt;212&gt; Type : PRT

&lt;211&gt; Length : 862

SequenceName : SEQ ID NO: 3

SequenceDescription : Protein sequence of full-length LOX-1 protein of cv. Barke

Sequence  
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EFLLKTITLH DVPGRSGNLT FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD 180  
ELRNRLRGDDQ QGPYQEHDRI YRYDVYNDLG EGRPILGGNS DHYPYPRRGRT ERKPNASDPS 240  
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGEFDSFQDI 300  
INLYEGGIKL PKVAALEELR KQFPLQLIKD LLPVGGDSLL KLPVPHIIQE NKQAWRTDEE 360  
FAREVLAGVN PVMITRLTEF PPKSSLDP SK FGDHTSTITA EHIEKNLEGL TVQQALESNR 420  
LYILDHHDRF MPFLIDVNLL PGNFIYATRT LFFLRGDGRL TPLAIELSEP IIQGGLTTAK 480  
SKVYTPVPSG SVEGWWELA KAYVAVNDSG WHQLVSHWLN THAVMEPFVI STNRHLSVTH 540  
PVHKLLSPHY RDTMTINALA RQTLINAGGI FEMTVFPKGK ALGMSAVVYK DWKFTEQGLP 600  
DDLIKRGMAV EDPSSPYKVR LLVSDYPYAA DGLAIWAIE QYVSEYLAIY YPNDGVLQGD 660  
TEVQA 665  
<212> Type : PRT  
<211> Length : 665  
SequenceName : SEQ ID NO: 4  
SequenceDescription : Protein sequence of inactive,  
truncated LOX-1 of mutant D112

Sequence  
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ccacaccaggc accatcacgg cgagcacat agagaagaac ctcgagggcc tcacggtgca	2520
cgaggtaatt ggtccaaagcc atcgacatca actatgattt acctaggagt aattggtagc	2580
tgtagataat ttggcttcgt tgcaattaaat ttgatgtgg ccgatcaagt gatcgtattg	2640
gttttgaat ttgcaggccg tggaaagcaa caggctgtac atcccttgcac accatgaccg	2700
gttcatgccc ttcctgatcg acgtcaacaa cctgcccggc aacttcatct acgcccacgag	2760
gaccctcttc ttcctgccc ggcacggcag gctcacggcg ctcgcacatcg agctgagcga	2820
gcccatcatc cagggcggcc ttaccacggc caagagcaag gtttacacgc cggtgcccag	2880
cggctccgtc gaaggctggg tggggagct cgccaaaggcc tacgtgcggc tcaatgactc	2940
cgggtggcac cagctcgta gccactggta cgttctccac ggtcgatgtg attcagtcag	3000
tcgatgcaca acaactgatc gaaatatgat tgattgaaac ggcgaggctg aacactcacc	3060

cggtgatgga	gccgttcgtg	atctcgacga	accggcacct	tagcgtgacg	cacccgggtgc	3120
acaagctgt	gagccgcac	taccgcgaca	ccatgaccat	caacgcgtg	gcgcggcaga	3180
cgctcatcaa	cgccggcggc	atcttcgaga	tgacggtgtt	cccgaa	ttcgcggtgg	3240
gatgtcggc	cgtgggtac	aaggactgga	agttcaccga	gcagggactg	ccggacgatc	3300
tcatcaagag	gtacgtacct	ggtaaatgtt	atgaatgtgt	aaaacaaatt	gggcgtctcg	3360
ctcaactgaca	ggaacgtggt	aaaaaaaatg	caggggcatg	gcgggtggagg	acccgtcgag	3420
cccgtacaag	gtgcgttgc	tggtgtcgga	ctaccgtac	gcggcggacg	ggctggcgat	3480
ctggcacfcc	attgagcagt	acgtgagcga	gtacctggcc	atctactacc	cgaacgacgg	3540
cgtgctgcag	ggcgatacgg	aggtgcaggc	gtgggtggaa	gagacgcgcg	aggtcgggca	3600
cgccgaccc	aaggacgccc	catggtgcc	caagatgcaa	agtgtgcccgg	agctggccaa	3660
ggcgtgcacc	accatcatct	ggatcgggtc	ggcgctgcat	gcggcagtca	acttcggca	3720
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catcacgagc	cagatccaga	ccatcatcg	cgtgtcgctg	ctggaggtgc	tgtcgaagca	3900
ctcctccgac	gagctgtacc	tcgggcagcg	ggacacgcgg	gagtggacct	cggaccggaaa	3960
gccccctggag	gtgttcaagc	ggttcagcga	ccggctggtg	gagatcgaga	gcaagggtggt	4020
gggcatgaac	catgacccgg	agctcaagaa	ccgcaacggc	ccggctaagt	ttccctacat	4080
gctgctctac	cccaacaccc	ccgaccacaa	gggcggccgt	gccgggctta	ccgccaagggg	4140
catccccaaac	agcatctcca	tctaa				4165

&lt;212&gt; Type : DNA

&lt;211&gt; Length : 4165

SequenceName : SEQ ID NO: 5

SequenceDescription : Barley genomic sequence of cv. Neruda spanning the start and stop codons of the gene encoding LOX-1

## Sequence

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&lt;213&gt; OrganismName : Hordeum vulgare mutant A618

&lt;400&gt; PreSequenceString :

atgctgctgg	gagggtgtat	cgacaccctc	acggggcga	acaagagcgc	ccggctcaag	60
ggcacggtgg	tgctcatgcg	caagaacgtg	ctggacctca	acgacttcgg	cgccaccatc	120
atcgacggca	tcggcgagtt	cctcgcaag	ggcgtcacct	gccagcttat	cagctccacc	180
gccgtcgacc	aggtaatca	ctaccctcct	ccggccttct	cctctgttta	caagatata	240
tatttctttc	gtgtggcccg	gcccgcattgg	atggatggat	gtgtctggat	cggttaaaga	300
agataggata	gttagccctg	ggcggtcgtc	tttacctgag	catgggcata	tgccatcgaa	360
aaaagagaca	acagcatgca	tgcgttgtgc	gcgcaccaga	ccacgcagag	caccggatgc	420
tcgagacaaa	gcaacacaac	aagcaaggac	gacacgtcaa	aagcaacaca	acaagcaagg	480
acggcacgtc	aaaagcaaca	caaaccctaa	ctaaagcaca	aagacgttaag	agcaagcaca	540
caatcagcag	gttataaaca	gttgcgtatca	aaaacaacgc	tggaaagagag	agagaaggaa	600

ggaagtagta	gccataaaaa	attaaatcac	cgggcgttgc	tcttgccca	acaattaatc	660
aaggaggata	cgtggcatgt	atagttcttg	taagtaaact	aagcatgtga	tatgagaagg	720
tacgtggtgg	tgcagacaac	ggcggtcgcg	ggaaggtggg	cgcggaggcg	gagctggagc	780
agtgggtgac	gagcctgccc	tcgctgacga	cggggagtc	caagttcgcc	ctcaccttcg	840
actgggaggt	ggagaagctc	ggggtgccgg	gcgcacatcg	cgtcaacaac	taccacagct	900
ccgagttcct	gctaaaacc	atcaccctcc	acgacgtccc	cggccgcagc	ggcaacctca	960
cttcgtcgc	caactcatgg	atctaccccg	ccgccaacta	ccgatacagc	cgcgtcttct	1020
tcgccaacga	cgtcgctgga	tttcctcta	cttcctctc	cttcatttt	caccgccttc	1080
gtcattcatg	gtcgatcatt	aagtcttgc	aggacaatag	atgatgagct	aggagttgg	1140
accacttagc	agtagtaca	ttatatttc	cgtgtggta	gaaaaggata	tggtttgg	1200
cagatcgaca	caagattgaa	tgaaagttgc	accgtggcac	cgtggcagcg	tggtaggtga	1260
aaataactgt	tgcacggatc	cacccacatg	attgtttca	tgaataaaact	tttaaggat	1320
gtgtctagcc	acatctagat	gcatgtcaca	taattattgc	ataccaaacc	gattaaatta	1380
agcataaaaaa	gaaaaggaaa	aaaataactca	catatctcg	cgtaaagatca	atgatatagt	1440
atttagatat	gcaatattta	tcttacatct	aaaccttct	tcattcctaa	atataagaca	1500
ttttaagat	ttcactatgg	acaacatacg	aaacaaaatc	agtggatctc	tctatgcatt	1560
cattatgttag	tctataataa	aatctttaaa	agatcgatata	tttgcacacg	gagggagtaa	1620
aacataactt	tttaatagta	atgttgcacg	gctccacact	cgcagacgta	cctgcccagc	1680
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aagctgcccc	aggtggccgc	cctggaggag	ctccgtaagc	agttcccgct	ccagctcatc	2160
aaggacctcc	tccccgtcgg	cggcgactcc	ctgcttaagc	tccccgtgcc	ccacatcatc	2220
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gttttgaat	ttgcaggcgc	tggaaagcaa	caggctgtac	atccctgtatc	accatgaccg	2700
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cggctccgtc	gaaggctggg	tgtggagct	cgccaaggcc	tacgtgcgcg	tcaatgactc	2940

cgggtggcac cagctcgta gccactggta cgttctccac ggtcgatgtg attcagtcag	3000
tcgatgcaca acaaactgatc gaaaatatgat tgattgaaac gcgcaggctg aacactcaccg	3060
cggtgatgga gccgttcgtg atctcgacga accggcacct tagcgtgacg caccgggtgc	3120
acaagctgct gagccgcac taccgcgaca ccatgaccat caacgcgctg gcgcggcaga	3180
cgctcatcaa cgccggcggc atcttcgaga tgacggtgtt cccgggcaag ttgcgttgg	3240
gatgtcgcc cgtgggtac aaggactgga agttcaccga gcagggactg ccggacgatc	3300
tcatcaagag gtacgtacct ggtaaatgtt atgaatgtgt aaaacaaatt gggcgctcg	3360
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cgtgctgcag ggcgatacgg aggtgcaggc gtgggtggaaag gagacgcgcg aggtcggca	3600
cgcgaccc aaggacgccc catggtgccca aagatgcaa agtgtgccc agctggccaa	3660
ggcgtgcacc accatcatct ggatcggtc ggctgcgtca gcggcagtca acttcggca	3720
gtacccctac gcggggttcc tcccgaaccg gccgacggtg agccggcgcc gcatgcggga	3780
gccccggcacf gaggagtacg cggagctgga gcgcgacccg gagcgggcct tcataccacac	3840
catcacgagc cagatccaga ccatcatcg cgtgtcgctg ctggaggtgc tgtcgaagca	3900
ctccctccgac gagctgtacc tcgggcagcg ggacacgcgcg gagtggaccc cggaccacaa	3960
gccccctggag gtgttcaagc gggtcagcga cggctgggtg gagatcgaga gcaagggtggt	4020
gggcatgaac catgacccgg agctcaagaa ccgcaacggc ccggctaagt ttccctacat	4080
gctgctctac cccaacaccc cccgaccacaa gggcgccgct gccgggctta ccgccaagggg	4140
catccccaaac agcatctcca tctaa	4165

&lt;212&gt; Type : DNA

&lt;211&gt; Length : 4165

SequenceName : SEQ ID NO: 6

SequenceDescription : Barley genomic sequence of mutant A618,  
 spanning the segment corresponding to the region between  
 the start and stop codons of the gene encoding LOX-1 of cv. Neruda

Sequence

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&lt;213&gt; OrganismName : Hordeum vulgare cv. Neruda

&lt;400&gt; PreSequenceString :

MLLGGLIDTL TGANKSARLK GTVVLMRKNV LDLNDFGATI IDGIGEFLGK GVTQLISST	60
AVDQDNGGRG KVGAEEALEQ WVTSLPSLTT GESKFGLTFD WEVEKLGVPG AIVVNHYHSS	120
EFLLLKTITLH DVPGRSGNLT FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD	180
ELRNLRGDDQ QGPYQEHDRI YRYDVYNDLG EGRPILGGNS DHPYPRRGRT ERKPNASDPS	240
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGEFDSFQDI	300
INLYEGGIKL PKVAALEELR KQFPLQLIKD LLPVGGDSLL KLPVPHIIQE NKQAWRTDEE	360
FAREVLAGVN PVMITRLTEF PPKSSLDP SK FGDHTSTITA EHIEKNLEGL TVQQALESNR	420

LYILDHHDRF MPFLIDVNLL PGNFIYATRT LFFLRGDGRL TPLAIELSEP IIQGGLTAK	480
SKVYTPVPSG SVEGVWWELA KAYVAVNDSG WHQLVSHWLW THAVMEPFVI STNRHLSVTH	540
PVHKLLSPHY RDTMTINALA RQTLINAGGI FEMTVFPKGK ALGMSAVVYK DWKFTEQGLP	600
DDLIKRGMAV EDPSSPYKVR LLVSDYPYAA DGLAIWHAIE QYVSEYLAIY YPNDGVLQGD	660
TEVQAWWKET REVGHGDLKD APWWPKMQSV PELAKACTTI IWIGSALHAA VNFGQYPYAG	720
FLPNRPTVSR RRMPEPGTEE YAELERDPER AFIHTITSQI QTIIGVSLLE VLSKHSSDEL	780
YLGQRDTPEW TSDPKALEVF KRFSDRLVET ESKVVGMNHD PELKNRNGPA KFPYMLLYPN	840
TSDHKGAAAG LTAKGIPNSI SI	862

&lt;212&gt; Type : PRT

&lt;211&gt; Length : 862

SequenceName : SEQ ID NO: 7

SequenceDescription : Protein sequence of full-length  
LOX-1 protein of cv. Neruda

## Sequence

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&lt;213&gt; OrganismName : Hordeum vulgare mutant A618

&lt;400&gt; PreSequenceString :

MLLGGGLIDL TGANKSARLK GTVVLMRKNV LDLNDFGATI IDGIGEFLGK GVTQCLISST	60
AVDQDNNGRG KVGAEEAEQ WVTSLPSLTT GESKFGLTDF WEVEKLGVPG AIVVNNYHSS	120
EFLLKTTITLH DVPGRSGNL FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD	180
ELRNRLRGDDQ QGPYQEHDRI YRYDVYNDLG EGRPILGGNS DHYPYPRRGRT ERKPNASDPS	240
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGEOFDSFQDI	300
INLYEGGIKL PKVAALEELR KQFPLQLIKD LLPVGGDSLL KLPVPHIIQE NKQAWRTDEE	360
FAREVLAGVN PVMITRLTMS QRLFVHCVCM VSMVRKCRS	399

&lt;212&gt; Type : PRT

&lt;211&gt; Length : 399

SequenceName : SEQ ID NO: 8

SequenceDescription : Protein sequence of inactive,  
truncated LOX-1 of mutant A618

## Sequence

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&lt;213&gt; OrganismName : Oligonucleotide

&lt;400&gt; PreSequenceString :

gaaagcgagg agaggaggcc aagaacaa

28

&lt;212&gt; Type : DNA

&lt;211&gt; Length : 28

SequenceName : SEQ ID NO: 9

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

ttattcatcc atggttgccg atggcttaga

30

<212> Type : DNA

<211> Length : 30

SequenceName : SEQ ID NO: 10

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

agggactgcc ggacgatctc a

21

<212> Type : DNA

<211> Length : 21

SequenceName : SEQ ID NO: 11

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

gccagctccg gcacactt

18

<212> Type : DNA

<211> Length : 18

SequenceName : SEQ ID NO: 12

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

```

<400> PreSequenceString :
caagggtgcgg ttgctggtgt c 21
<212> Type : DNA
<211> Length : 21
    SequenceName : SEQ ID NO: 13
    SequenceDescription : Oligonucleotide primer used for PCR
amplification (sense primer)

Sequence
-----
<213> OrganismName : Oligonucleotide
<400> PreSequenceString :
ctcgcgcgtc tccttccac 19
<212> Type : DNA
<211> Length : 19
    SequenceName : SEQ ID NO: 14
    SequenceDescription : Oligonucleotide primer used for PCR
amplification (antisense primer) Sequence
-----
<213> OrganismName : Oligonucleotide
<400> PreSequenceString :
ctcgcgcgtc tccttccat 19
<212> Type : DNA
<211> Length : 19
    SequenceName : SEQ ID NO: 15
    SequenceDescription : Oligonucleotide primer used for PCR
amplification (antisense primer)

Sequence
-----
<213> OrganismName : Oligonucleotide
<400> PreSequenceString :
tacgtgccgc gggacgagaa g 21
<212> Type : DNA
<211> Length : 21
    SequenceName : SEQ ID NO: 16
    SequenceDescription : Oligonucleotide primer used for PCR
amplification (sense primer)

```

Sequence  
-----  
<213> OrganismName : Oligonucleotide  
<400> PreSequenceString :  
tgatcatgac cgggttgacg t 21  
<212> Type : DNA  
<211> Length : 21  
    SequenceName : SEQ ID NO: 17  
    SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

Sequence  
-----  
<213> OrganismName : Oligonucleotide  
<400> PreSequenceString :  
catatgcgtgc tggagggt g 21  
<212> Type : DNA  
<211> Length : 21  
    SequenceName : SEQ ID NO: 18  
    SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence  
-----  
<213> OrganismName : Oligonucleotide  
<400> PreSequenceString :  
gaattcttag atggagatgc ttgggg 27  
<212> Type : DNA  
<211> Length : 27  
    SequenceName : SEQ ID NO: 19  
    SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

Sequence  
-----  
<213> OrganismName : Oligonucleotide  
<400> PreSequenceString :  
ctaccgtac gcggcgacg ggct 24  
<212> Type : DNA

<211> Length : 24  
SequenceName : SEQ ID NO: 20  
SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

tcctgaattc acgcctgcac ctccgtatcg c

31

<212> Type : DNA

<211> Length : 31

SequenceName : SEQ ID NO: 21

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)